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METEOROLOGICAL OBSERVATIONS.

In returning thanks to our correspondents, for their various favors in the last volume of the Journal, by some strange oversight, we omitted to mention our esteemed friend *P. G. Voorhees,* whose valuable tables have been continued regularly ever since the commencement of this work. This gentleman has not only conferred a favor upon us, but has merited the thanks of the scientific world, for his perseverance in continuing observations which are, as far as we know, the only ones upon which any accurate deductions of the mean annual temperature of that vicinity can be based. It is highly important to ascertain whether there are any changes in this mean, and if so, what their character and amount is. We should be delighted to find other gentlemen in the more remote portions of the United States, following up a similar plan.

While we are on this subject, we beg leave to make a few remarks upon a topic of much interest. We refer to the duty which we consider incumbent on civil and military Engineers to engage in systematic and accurate meteorological observations it is very certain that there is no class of men so well suited to the performance of this duty, whether we consider their general distribution over the country, or their peculiar adaptation by reason of their previous education and training. As good observers, civil Engineers stand unrivalled. They are better able to endure the peculiar fatigue arising from long continued exertions of this kind, and in this country at least, they are generally accustomed to great accuracy in the use of their instruments.

Our general government, aware of the advantages to be derived from observations over the wholee xtent of our country, has employed M. Nicollet to prepare for the use of the officers of the army and navy, instructions for this purpose. These are in their way very good, and could a sufficient number be distributed among the civil Engineers of the United States, much good might result.

It is not to be expected that many individuals should engage in the most complete series of observations—yet each one has his peculiar province in which to collect useful facts.

Those who are resident upon our great lakes or rivers, can with but little trouble to themselves, obtain the most valuable results, by comparing the rise and fall with the temperature, quantity of rain, and rate of evaporation, or dew point. Annual tables of this description would lead to practical applications of extended utility.

The mean annual temperature of any one place as obtained with a very trifling exertion of attention and expense of time is datum exceedingly necessary to the most advantageous construction of all works in which iron is extensively employed. The almost entire destruction of the stability of a railroad, can be occasioned by a very trifling oversight in this respect. This indeed, is only one of many professional applications of meteorological science, which would seem to invite Engineers into this fruitful field of observation.

In England, Col. Ried has drawn attention to the subject, and engaged the Royal Engineers in the cause. Our seaboard inhabitants have ample means for testing these theories of storms, but we are almost without data for ascertaining the laws which regulate the atmospheric currents, in the "far west." That these are in a manner similar to those which circulate over the Atlantic there can be but little doubt, still the great changes and deflections produced by obstacles, attaining a considerable elevation in the centre of a large continent, must produce results which cannot be anticipated, and yet remains to be developed from observation.

Barometrical observations are in many cases practicable, and in their result of extreme utility. We wish that our friend Voorhees would add a barometer to his other instruments, and thus more than double the value of his tables.

It is certain that the barometer may be employed, when in the hands of one thoroughly acquainted with the instrument—as a rapid and economical means of obtaining approximate elevations in situations remote, either in distance or elevation, from any point of a carefully levelled line. For ascertaining the lowest pass of an extensive ridge, the barometer affords a far more expeditious and more eligible mode than the level. We are convinced that this instrument has been too much neglected by Engineers, and is capable of far greater accuracy than is commonly imagined.

The fluctuations of the dew point are also of much utility in the construction of canals, and have in connection with the observations on the rain gauge received some attention from Engineers, but far less than they really deserve.

Without entering into further details, we may remark that the plan of taking meteorological observations simultaneously, on certain days, deserves the attention of our Engineers; several persons have taken the mat-

ter up, in the United States, but nothing like the general co-operation desir- has yet taken place.

We throw out these hints for the purpose of drawing attention, and at any time shall feel happy to communicate any information that may be desired.

For the American Railroad Journal, and Mechanics' Magazine.

METEOROLOGICAL RECORD FOR THE MONTHS OF MARCH and APRIL, 1840.

Kept on Red River, below Alexandria, La., (*Lat.* 31.10 *N.*, *Long.*, 91.59 *W.*)

1840	THERMOMETER.					
Mar	Morn.	Noon	Night.	Wind.	Weath.	REMARKS.
1	64	62	62	SE	cloudy	rain in the evening
2	64	66	62	calm	clear	
4	58	68	64	NW	..	
4	56	72	76	calm	..	Red river rising
5	56	72	74	..	..	
6	58	76	74	..	..	
7	62	76	76	SW	..	
8	63	82	78	S	..	
9	66	70	72	SE	cloudy	showers in the evening, with heavy distant
10	58	68	64	NW	clear	[thunder
11	56	66	64	..	..	
12	54	64	60	..	..	
13	52	66	62	..	..	
14	58	70	68	SE	cloudy	heavy thunder showers in the evening
15	68	76	72	..	..	showers through the night
16	70	76	74	calm	clear	
17	70	74	70	..	cloudy	showers all day
18	70	78	72	S	clear	
19	72	82	80	calm	..	
20	60	54	50	NW	..	
21	49	53	48	..	..	
22	46	50	46	N	cloudy	
23	52	54	48	..	clear	
24	44	52	58	W high	cloudy	rain and hail in the evening, wind high all night
25	46	48	44	..	..	rain in the evening
26	46	50	43	N	clear	
27	63	74	68	calm	cloudy	
28	69	72	71	..	..	
29	62	68	63	S	..	rain all day
30	68	70	65	calm	clear	
31	44	58	56	W	..	white frost
	59	67	64	....	....	mean temp. of the month 63.3
Apr.						
1	50	60	59	NE	cloudy	light rain
2	56	60	59	calm	..	
3	60	62	63	..	..	heavy thunder and rain in the morning
4	66	68	70	S	..	foggy morning light shower all day
5	68	72	72	..	..	foggy morning
6	69	76	78	..	clear	
7	64	72	72	SW	..	heavy thunder shower in the morn'g clear day
8	60	69	66	NW	..	
9	60	69	69	calm	..	
10	66	72	71	SE	cloudy	thunder showers in the night
11	67	78	74	SW	..	
12	70	70	66	..	clear	light showers in the morning clear day
13	60	71	70	SE	cloudy	morning clear day
14	70	81	78	calm	clear	
15	70	72	73	..	cloudy	heavy thunder showers morning and forenoon
16	69	80	79	S	clear	foggy morning, clear day [evening clear
17	72	79	78	S high	cloudy	morning, clear day
18	72	80	74	SW	..	heavy thunder W to N, no rain
19	68	68	67	NE	..	heavy thunder in the morn'g, no rain, thunder
20	64	76	76	SE	clear	shower in the evening
21	68	86	80	calm	..	
22	70	86	80	S high	..	
23	74	86	80	..	..	
24	76	86	80	S light	cloudy	morning, clear day
25	74	87	82	..	..	"
26	70	80	75	N	clear	light showers at noon
27	64	78	70	NE	..	heavy thunder in the S W, no rain
28	66	84	70	calm	cloudy	light thunder shower from S W
29	72	82	76	..	clear	thunder shower in the morning, clear day
30	72	87	82	SW	..	lightning in the north at night
	67	76	73	....	....	mean temp. of the month, 73.

To the Editors of the American Railroad Journal, and Mechanics' Magazine.

GENTLEMEN:—In your last number, I perceive the crank is again a subject of discussion. I have hitherto trenched upon this subject, only so far as it was connected with my "true (and I may add new) expression of the powers of locomotive engines"—as developed in several papers published in the Journal.

I felt myself particularly called upon, to illustrate and define the effect of the crank, when recently it was attempted to account for the deviations of De Pambour's formula from experience, by an absurd estimate of the actual loss, at variance with the implications of my expression. I might on that occasion have put aside the question, with the single remark, that its effect was included with the utmost precision in the item "friction," which had been determined accurately by experiment; but for the sake of illustrating the long mooted principle of crank motion, in a new mode, not liable to the objection of error, from fallacious reasoning upon absurd premises, I chose to dilate more largely than was strictly required of me, and to deduce the amount of loss from experiment alone.

As observed in setting out, the subject has again come up, in such a way as to require from me, some attention. I must, however, throw myself upon reserved privileges in future—being indisposed to run a tilt Quixotic after every errant and gratuitous assertion relating to this subject—as an attentive perusal of the accomplished Engineer, will satisfy him of the correctness of my previous investigations.

Your correspondent observes, "that three of your correspondents have lately assumed positions respecting the crank, that if proved, would annihilate the whole theory of mechanics, and lead directly to perpetual motion," and quotes my remark that "the force in passing from its primitive direction, to its final direction in the tangent to the rotary circle of the crank, must evidently lose two proportions," etc.

All the verbal sophistry employed by Mr. Aycrigg, in convincing himself of the tendency he has asserted, need not be examined; and his demonstration of the nullity of loss of effect (which I presume he finds necessary to support the vagary of a perpetuum mobile into which he had sophisticated himself) may be controverted in a very few remarks, and with very little difficulty. For either very little skill or very little caution could have led him to assume as the *basis of all he has said or done*, the profound absurdity of making a *component* of two rectangular forces coincident with the *resultant*; that is, when resolving the force, in making $p = P \text{ sec. } d$, instead of $p = P \text{ cosin. } d$.

For in that way it is quite evident that the force of the piston would become a much more wonderful affair than even a perpetual motion—since when the angle d is near a right angle, the force upon the piston would be *multiplied to an unlimited extent*; and by combining several connecting rods, changing the direction of the force at each, according to this postulate, a power quite unlimited might be *created*; and an animalcule might

be substituted for the gigantic power which men have hitherto found it necessary to employ. All this is of course chimerical, and the result of incorrect analysis—since p, on the contrary, *is diminished by means of the connecting rod*, in proportion to the cos. of the angle d; and, so far from ever exceeding the force upon the piston to an infinite degree, is always less than it, except (for an instant) at the commencement of the stroke—when they are equivalents, and p has its greatest possible value.

It would suffice to add that this incautious assumption is the *basis of all the inferences and apprehensions* of Mr. A. Of course the "castles airy," which he has been at the trouble of erecting, tumble into a promiscuous chaos of cloud and vapor; but as the principle of virtual velocity has been violated equally in the proportion

$$V : v :: \sin. c : R$$

which is another part of his demonstration, it may be adduced as a matter which would equally overthrow the whole fabric.

Mr. Aycrigg observes in conclusion, "one of the gentlemen whose words I have quoted, refers to defects in De Pambour's formula, and shows that a uniform loss from the crank, will not remove the difficulty."

"I will add (he continues) that if we reject the formula and take the experiments, we will find in them a proof that there is no loss from the crank."

To the first of these observations I cannot object. But the last, the reader of my paper can hardly, I should think, fail to perceive to be mere assertion; since what Mr. A. terms "calculations," are purely *numerical statements* of the *results of experiment*, having no connection whatever with De Pambour's formula, or any other. It would be just as proper to say, that on determining by experiment any two pressures of steam, that the numbers expressing the degrees of pressure were "calculations," as that the statements referred to were so. Indeed, as has been remarked, I had, on the face of my paper, disclaimed all other modes of investigation but experimental.

It will be understood that my determination of the loss of effect from crank motion agrees as little with the other determinations quoted by Mr. A., as it does with his own. I mention this, that I may not be understood as vindicating any but my own investigations.

Very respectfully yours,

Wm. Mc C. Cushman.

Albany, 11*th June*, 1840. *Civil Engineer.*

P. S.—An obscurity has been created in the paper upon the crank, by an error or two of the press, which may be corrected on this occasion. The original reading was "bear some constant relation to the power expended, or the total resistance," instead "*be on* some constant relation to the power expended *on* the total resistance;" and in another place, "the resistance of an unloaded engine," instead of "this resistance," etc.

W. Mc C. C.

For the American Railroad Journal, and Mechanics' Magazine.

FARMINGTON AND HAMPSHIRE AND HAMDEN CANALS.

In the last number of the Journal, is a communication on the subject of the Farmington and Hampshire and Hamden canals, in which the writer recommends that the canal be converted into a site for a railway, as being the best disposition that can now be made of that work. That the canal has proved a complete failure is well known, the revenue upon it being entirely inadequate to keep it in repair. And it is also quite evident that the modicum of aid which it has recently received from the city of New Haven, can have no other effect but to prolong for a very limited period its frail existence. It will be recollected that when this canal was projected it was intended as a rival to the project of improving the Connecticut river. Our object in inviting the attention of the readers of the Journal to the subject at the present time, is to remind them of a communication from the pen of E. F. Johnson, Esq., Civil Engineer, addressed to those interested in the work, more than twelve years since, in which the two projects are compared somewhat in detail, and results predicted which have since transpired to the letter.

Mr. J. exposes in the first place the fallacy of the principle, with which the minds of leading men were at that time strongly imbued *that it was better in most, if not all cases, to construct an independent canal, than to endeavor to improve the channel of a river.* This was then, as Mr. J. stated "the generally received opinion with the Engineers in the Old Countries, particularly in England," and so firmly persuaded was the celebrated Engineer Brindley of the correctness of the opinion, that he would not allow that rivers were useful for any other purpose than to "feed navigable canals,"

The reasons assigned for this opinion, were

1st A diminution of the distance as compared with the rivers.

2d A saving in expense or a better navigation at a nearly equal expense.

3d A saving in time, there being less delay and more certainty, with no more lockage on the canals than upon the rivers.

Mr. J. remarked that these reasons, although entitled to much weight when applied to a country like Great Britain, owing to the limited size of the rivers, and their serpentine character, and the state of the sciences and the arts in that country at the time the question of inland navigation was most discussed, were not applicable to the case under consideration, and for the follwing general reasons.

1st The distance to tide-water was considerably less by the river than by the proposed canal.

2d A great saving in lockage by the river, there being full ten times as many locks upon the canal as upon the river.

3d The magnitude of the river exceeding that of the English rivers, permitting the use of steam to advantage, a species of power more economical under the circumstances than that of horses on the canal, and less un-

derstood at the time in its application to river navigation in England than in the United States.

4th A saving in the entire cost of a towing path on the bank of the river above the reach of floods; an improvement which was indispensable on the English rivers.

5th The population being the greatest, and the business of the country having already centered to a very considerable extent upon the banks of the river, it would not be easy to divert it from its accustomed channel.

6th The lumber which formed the greater portion of the tonnage of the Connecticut river valley would continue, owing to the cheaper mode of transit and expense of transferring to canal boats, to be floated down upon the river.

7th. The greater speed attainable upon the river with steam as a propelling power; being probably double or treble that upon the canal.

The above with various other reasons were adduced by Mr. J. as conclusive in his own mind, in respect to the impolicy of constructing the canal. The advocates of the project, firm in the belief of the superiority of a canal to river navigation, and stimulated by the extraordinary success which attended the first opening of the Erie canal, and encouraged by the opinion of Clinton, that the Farmington canal would eventually be to New Haven what the Erie canal was to Albany, became so deeply enamored of the project, as to be beyond the reach of argument, and no reasons, however cogent, could be urged to induce an abandonment of the undertaking.

The result is now known, and it were a painful task to enumerate the suffering produced by the hundreds of thousands of dollars lost to its proprietors and to the world forever, unless the labor expended can be appropriated to some profitable use, (a railway for instance,) as suggested in the paper to which we referred at the beginning of this article.

It is worthy of notice that the canal has proved a total failure, notwithstanding the improvement of the river for the use of steam, has not been carried higher up than Springfield, 16 miles below the point where the canal leaves the river. This again fully confirms the opinion advanced by Mr. J. in the communication referred to, which we quote as follows, in his own words. He says:

"Without wishing to arrogate to ourselves any thing like superior wisdom, we will venture to affirm, that *if the construction of the canal were made a question of expediency, without any reference to the rival project of improving the river, it could not be answered in a manner sufficiently satisfactory to warrant engaging in its execution.*"

It was in the same year or shortly after, the publication of the above communication of Mr. Johnson, that he presented his views in a general form as to the relative merits of railroads and canals, while discussing the importance of a railway communication leading from New York city to the Mississippi valley, and in which he arrived at the conclusion, that "*railways as a means of inter-communication, possess properties which in many*

situations will render them superior to canals, and that with reference to the United States, considering how diversified it is with hills and vallies, railways when properly constructed will be found the most valuable and effective, and *that ultimately when their merits become better known and more fully appreciated, by far the greater portion of the inland traffic and travel will be conducted upon them.*"

The truth of this prediction, is daily becoming more and more manifest, and in no instance, perhaps, is it forced upon the mind in a stronger light than in the case of the Farmington canal as compared with the New Haven and Hartford railroad, the one of little comparative value to the community, a curse instead of a blessing to its proprietors, and on the verge of being abandoned—the other rapidly taking rank among the great great leading thoroughfares of the country.

SMEATON.

Can any of our friends us furnish with a correct statement of the arrangement of the grades and curves upon the Housatonic railroad, from Bridgport to the north line of Connecticut? We should like also, a similar statement, relative to the continuation of that line to West Stockbridge in Massachusetts.

We extract the following useful tables from Mr. C. Ellet's report on a suspension bridge over the Mississippi, at St. Louis. We shall have occasion again to notice this report.

TABLE OF THE TENACITY OF BAR IRON AS GIVEN BY DIFFERENT EXPERIMENTERS.

Names of experimenters.	OBSERVATIONS.	Cohesion per square inch.
		TONS.
Perronet.	On bars about 1-2 inch square. Mean of 11 experiments.	27.0
do.	On round bars 2-5 inch diameter. Mean of 11 experiments.	26.6
Soufflot and Rondelet.	On bars 1-6 of an inch to 1-2 inch square. Mean of 16 experiments.	29.5
Poleni.	On bars about 1-10 of an inch square.	28.0
Telford.	On bars of Welsh, Swedish and Staffordshire iron, from 1 to 2 inches in diameter. Mean of 9 experiments.	29.3
Brown.	On bars of Welsh, Swedish and Russia iron, from 1 to 2 inches in diameter. Mean of 8 experiments.	25.0
Barlow.	On bars of medium quality, 1 inch. Mean of 4 experiments.	25.2
Brunel.	On Yorkshire iron of first quality, from 3-8 to 1-2 in. square. Mean of 10 experiments.	32.8
do.	On Yorkshire iron of second quality, of the same size.—Mean of 10 experiments.	30.8
Seguin.	Small bars of French iron. Mean of 9 experiments.	27.6
	Mean of all the preceding results,	28.2

TABLE OF THE ULTIMATE STRENGTH OF IRON WIRE AS OBTAINED BY DIFFERENT OBSERVERS.

Names of experimenters.	OBSERVATIONS.	Cohesion per square inch.
		TONS.
Seguin.	On wire varying from 1-120 to 1-4 of an inch in diameter. Mean of 25 experiments.	44.2
Dufour.	On wires of different sizes—from 1-30 to 1-8 of an in. diam.	41.5
Telford.	On wires from 1-16 to 1-5 inch in diam. "*These wires all broke at joints or unsound places.*"	38.4
Chaley.	On wire about 1-100 of a foot in diam. used in the construction of the Freibourg Bridge.	51.7
	Mean of all the preceding results,	44 tons.

Williams' Register, we understand, will soon be ready for delivery, replete, as usual, with interesting statistical information. We are favored with the following condensed view of the railroads of this State, prepared for that valuable work.

RAILROADS IN THE STATE OF NEW YORK.

From the peculiar formation, and situation of the State of New York, she is the best located of any State, between the upper lakes and the Atlantic Ocean, to be benefitted by a well digested system of railways. The natural breakwater of Long Island gives to New York the best harbor on the sea board, with the advantage of two outlets to the ocean, at all seasons of the year, for the largest class of vessels.

The Hudson river, and its tributary, the Mohawk, are the only streams that penetrate the Apalachian ridge. These mountains under different names, extend from the northwest part of the State of Georgia, to the northeast angle of the State of Maine. The lowest summit of this ridge is at Rome, Oneida Co., N. Y., 425 feet above tide-water. At Rome, the waters unite at the old Indian portage, in the Erie canal, and then divide for the ocean. The outlet in the direction of the St. Lawrence valley, is by Wood and Fish creeks, the Oneida lake and river, and the Oswego river to lake Ontario at Oswego. One of the advantages of the route through this State is that the distance is only 168 miles from tide-waters at Albany to the upper lakes at Oswego. It now requires the construction of but 35 miles of railway, from Syracuse to Oswego, to complete this line by railways to the west.

With the addition of 150 miles from the line of the Oswego railway along the ridge road, the important port of Buffalo may be reached with a gradual rise of 140 feet from the Rome level, thus favoring the descending trade to the Hudson, with an average of less than 2 feet to the mile.

To reach lake Erie from Boston, by the *Massachusetts* "*Western railroad*," via. Worcester, Springfield, Pittsfield and Stockbridge, and from thence by Albany and the valley of the Mohawk, the distance is 517 miles. The grades in Massachusetts to enter this State at the Cannon Gap, run up to 80 feet in the mile, to pass the summit (1440 feet,) near Pittsfield. This road is in operation from Boston to Springfield, on the Connecticut river; from that point to the State line of New York, it is under contract, and will be completed by the spring of 1841. From the long wharf in Boston to the Hudson river, this line of railway will cost $6,500,000. The State of Massachusetts has loaned its credit for $3,300,000, towards the prompt completion of the Western railway, to perfect the long desired object of Boston—a direct trade to the west, through the valley of the Mohawk, to exchange her manufactures, oil and fish, for our breadstuffs, provisions, including the whole trade of the west. The great distance from Philadelphia to the ocean, by the Delaware river and bay, with the obstructions by ice, has made that place tributary to New York, since the construction of the Camden and Amboy railroad. The amount Philadelphia has paid us as factors and importers, for an early selection of our goods, has been amply made up to her, by the fostering care of her legislators to secure a line of railroads and canals to the valley of the Ohio. This line has to pass the Allegany mountains at Hollidaysburg, with ten inclined planes, on each side of the ridge, at an altitude of 2397 feet above tide waters.

With this difficult and mixed line of railways and canals, the State of Pennsylvania takes a large share of the early transportation from New York, and Philadelphia has the advantage of the sales of a large amount

that should be made in the city of New York. A barrel of flour costs (1840) $1 55 transportation from the Ohio river to Philadelphia, the bounty of twenty cents paid by the State taken into consideration. The railway from Baltimore through Maryland to Wheeling, on the Ohio, has to surmount an elevation of about 2500 feet; neither the line by Baltimore or Philadelphia, can successfully compete with the southern and northern railways of New York.

The southern or New York and Erie railroad, starts from Tappan, now called Piermont, on the Hudson river, 25 miles from the city hall; it passes through the southern tier of counties by Goshen, Binghamton, Owego, Elmira, and Olean to Dunkirk, on lake Erie. The distance by Judge Wright's report, to Dunkirk is 508 miles. The grading at each termination of the road is under contract, and nearly completed; there are under contract 222 miles, on the following parts of the road; Hudson river to Middletown, Orange co., 55 miles—section on the Delaware, 40—Binghamton to Hornellsville, 117—western termination, 10. The grades since the first surveys, have been reduced to 60 feet to the mile, and the distance shortened 25 miles, by a survey made by E. F. Johnson, Esq. The inclined planes at the Hudson river and lake Erie, have been dispensed with, and the line much improved by recent surveys. The importance of this railroad to the southern tier of counties, is easily seen, when it is taken into consideration that it will connect the city of New York with the coal and iron regions of Pennsylvania; with the Allegany river at Olean point, and with the Genesee valley canal at Olean point, also the Chenango canal at Binghamton. This road is advantageous to the State, to develope the resources of a rich agricultural and dairy district, with one unbroken line, and under one charter, from Piermont (or Tappan) on the Hudson river to Dunkirk, on lake Erie. The cost for a single track, owing to the cheapness of lumber, and other favorable circumstanses, may be estimated at $6,000,000. The State passed a law in 1837, to furnish $3,000,000 towards the construction of this road, in the ratio of dollar for dollar—as the company expended $100,000, they are entitled to receive a like sum from the State. Under this law they have received $400,000. A law has passed the present legislature, to grant the company in the proportion of $2 for $1, they shall expend in its construction, on the pledge of the road as security, for the interest and principal of the loan.

The northern or middle line of railway to connect the city of New York with Buffalo, in one unbroken chain, from the city hall, by Albany, Troy, Utica, Syracuse, Auburn Rochester and Batavia, consists of 9 separate companies. A short sketch of the several companies, will convince the most skeptical, that there is no route from the seaboard to the vallies of the St. Lawrence and Mississippi, that can compete with this line, when it is stated that from Buffalo to Albany, it gradually descends to the Hudson river, at the average rate of 2 feet to the mile. From Albany to New York the road passes through the eastern parts of the counties of Rensselaer, Columbia, Dutchess, Putnam and Westchester, to the Harlem river, with no grade on the whole distance to exceed 30 feet to the mile. The summit east of the Hudson is situated in the town of North East, in Dutchess co., 25 miles from the Hudson. At this point it is 769 feet above tide water. This is less by 300 feet than the lowest summit from the Atlantic to the vallies of the St. Lawrence and the Ohio, with the exception of the passes through the Highlands and at Little Falls, by the Hudson and Mohawk rivers. It has been previously stated, that on this line west of the Hudson river, that the elevation at Buffalo (with no great intervening obstacles) is 565 feet above tide waters. It is estimated that trains of 200 tons of goods

can be carried over this road, at the rate of 10 miles per hour, with the same ease that 101 cars have beeg drawn by one engine, over the Philadelphia and Reading railroad, loaded with 307 tons of goods nett, (exclusive of cars engine and tender,) at the same rate of speed.

The roads on the northern line, under the several charters, are as follows: The New York and Harlem railroad Co., was chartered 1831: the road is 7¾ miles long from the city hall to the free bridge over the Harlem river. At this point it is designed to connect this road with the New York and Albany railroad. The Harlem company after encountering many difficulties have completed a double track nearly the whole distance to the bridge on the Harlem river, at the end of the 4th Avenue. The company has overcome obstacles in rock excavations, tunneling, and embankments, unequalled by any road in this country, or in Europe, for the same distance. The two tracks with depots, fixtures and motive powers, it is stated, have cost $1,100,000.

The receipts for the year ending the 1st April, 1840, were $104,501 50.

Since its completion, 3,810,000 passengers have passed over it, to the great accommodation of the public. The officers of the company are

Sam'l. R. Brooks, *Pres't.*	Thos. A. Emmet, *Vice Pres't.*
Thos. Sargeant,	Isaac Gibson,
Samuel Meredith,	William P. Hallett,
Shepherd Knapp,	David Banks,
Henry Erben,	Henry Yates,
John V. Greenfield,	John Ward, *Directors.*

The charter of the New York and Albany railroad was granted in 1832 and the company was organized in 1838, with the following directors:

Chas. H. Hall, *Pres't.*	Jacob Harvey
Jonathan P. Hall,	Isaac Adriance,
John Harris,	Jacob T. Merritt,
Lewis G. Morris,	Fras. Barretto,
Jos. W. Tomkins,	Jonathan A. Taber,
Jonathan Aikin,	Gouverneur Morris,
Benjamin Wright,	Jos. E. Bloomfield, *Commissioner.*

The recent surveys of this railroad, made under the direction of the Commissioner, Jos. E. Bloomfield, have resulted in the discovery of a route entirely within our own State, on which no inclined plane, or tunnel is necessary. The spur of hills or branch from the Highlands, extending into Vermont, is passed by a remarkable level valley, formed by the Croton river, the Oblong and Clive creeks; with no grade from the Harlem river to Albany that exceeds 30 feet to the mile, and it is remarkable that the distance from the city hall to Albany, 147 miles and 71 chains is less than by the Hudson river.

There are two summits, one in Westchester, the other in Dutchess co. 769 feet above tide water. Proposals have been made to the company to construct this road in thirty months, (exclusive of right of way ceded to a great extent,) for the sum of $2,450,000 including 10 engines and cars to operate the road. The first section has been put under contract up to Williams' bridge in Westchester at less than this average per mile.

The next link in the line is the *Mohawk and Hudson railroad*, extending from Albany to Schenectady 15¾ miles. This road was one of our first experiments, and cost $1,100,000, upwards of $70,000 per mile for a double track; it has two inclined planes, entirely unnecessary. These will be dispensed with, as well as on the new road the city of Troy proposes to build from their railroad bridge over the Hudson at Troy to Sche-

nectady. The distance 15 miles, and no grade to exceed 60 feet, to descend to the Hudson. From Schenectady to Utica, the distance is 78 miles. This road owing to its being located by law on the north side of the Mohawk has cost $1,540,000 for a single track, with 20 miles turnout in the centre; it now divides 12 per cent. per annum, with a yearly increasing surplus. This income is derived from passengers and conveying the United States mail. By a singular policy of the State, this road has been confined to the transportation of passengers, although the public have repeatedly petitioned to the legislature to permit the company to carry freight, paying therefor, into the State treasury the same tolls as charged on the Erie canal. The company have finally been permitted to carry extra baggage, for passengers, provided no charge is made therefor by the company.

The variety of manufactured cotton and woollen goods in Oneida co., and on the route, with the raw material of cotton from the new crop, required from the seaboard, after the closing of the Erie canal ,renders it very desirable that this *Utica and Schenectady railroad Company*, should have permission to carry freight on paying canal tolls to the State Treasury and thus greatly accommodate the public. It can be no injury to the trade on the Erie canal, or the revenue of the State, but will tend to relieve it, at its most crowded point.

The Utica and Syracuse railroad, next in order, is 53 miles long with a single track built partly on piles; it has cost $900,000. From its completion with a single track, (July 3d, 1829) to the 1st. Jan. 1840 this road received from passengers and the U. S. Mails $117,614 and has realized a nett revenue for the first six months of 10 per cent. A charter has been granted to construct, a *railroad from Syracuse to Oswego* on Lake Ontario, a distance, with easy grades, of 35 miles. This road has been surveyed during the last season and it has the advantage (to travellers to Queenston, Lewiston and Kingston) of affording them an opportunity of sleeping in the Steamboats on Lake Ontario. On the construction of the "Western railroad" through Upper Canada from Hamilton to the Thames river and Detroit, this line of railways and Lake navigation will be an important thorughfare to the west and north west with rest at night in steamboat.

The main road is completed from *Syracuse to Auburn* a distance of 26 miles at the cost of $460,000; it is considered one of the best on the line and is productive to its stockholders. *The Auburn and Rochester railroad*, passes some distance south of the Erie canal, through the flourishing villages of Geneva and Canandaigua a distance of 77 1-2 miles. This line is represented as 24 miles longer than the route through Lyons.

Thirty miles of the road, between Rochester and Canandaigua will be graded this year. The road is estimated to cost $1,250,000 and with the aid of the State the whole line may be completed at the close of the year 1841; it passes through a rich Agricultural district; the granary of the State of New York.

The *Tonawanda* (*or Rochester and Batavia*) railroad has been finished to Batavia, at an expense of $400,000 for 33 miles. Attica lies south of Batavia 11 miles, thence to Buffalo the distance is 30 miles. A charter has been obtained to make a road from Attica to Batavia. From Batavia to Buffalo by the direct route the distance is 34 miles. This line, from Rochester to Buffalo, 67 miles, is so near a straight line that it only diverges ¾ of a mile to pass by Batavia. The ground for the construction of this road to Buffalo has been granted (from Batavia to Buffalo) to an enterprising company. They have surveyed and located it with the intention of completing it as soon as the Auburn and Rochester railroad is finished.

From this view it will be perceived that the *Northern Line* of railroads

from the City Hall New York, to Buffalo, can be located near the Erie canal, on a very *level route*, with a distance not to exceed 440 miles, and if extended from Buffalo to Dunkirk, (40 miles, for which a charter has been granted,) the distance will not exceed 480 miles. Off from the main line we have the *Buffalo and Niagara* railroad extending from Buffalo by Black Rock to Niagara Falls, 23 miles, at the cost for a single track on wood, of $110,000. The *Lockport and Niagara Falls* railroad extends from Niagara Falls by Wheatfield and Cambria to Lockport, distance 20 miles, capital $175,000. The *Rochester* railroad descends from Rochester on the east bank of the Genesee River 255 feet to the port at the mouth of the river—cost $30,000.

In addition to the above we have the *Rensselaer and Saratoga* railroad (from Troy to Saratoga) distance 21 1-2 miles, cost $450,000. The *Schenectady and Saratoga* railroad distance 23 1-2 miles cost $277,237 for a single track. Both these roads have been in successful operation for several years. An extension of this line has been surveyed and located from Saratoga to Whitehall, distance 43 miles, to connect with Lake Champlain.

A report has been made to the present Legislature 1840 to extend the Troy and Saratoga railroad to the sources of the Hudson river,(in the place of a canal,) thence by *Long Lake and Racket river* to Ogdensburgh.

This road will open for sale 500,000 acres of land, belonging to the School Fund.

The *Ogdensburgh and Chanplain* railroad by Malone and Plattsburgh has been surveyed by Edwin F. Johnson Esq. under the direction of a law of the State. The length is 122 miles, estimated cost $1,451,805. There is another line for the same road, with nearly the same distance examined by Mr. Johnson by the river Au Sable, less exposed to the frontier.

The foregoing presents the *three great lines of* railroads, introduced by Gov. Seward in his first message to the Legislature, as important to connect the vallies of the Mississippi and St. Lawrence with the city of New York. Indivdual enterprise by the *Brooklyn* and *Long Island* railroad Companies has constructed a railroad on Long Island from Brooklyn, by Jamaica, to Hicksville, distance 27 miles at a cost of about $800,000.

This road is designed to connect the city of New York (by Greenport, at the east end of the Island, thence by the Sound and Stonington railroad) with Boston.

The following are the detached railways from the main lines, completed and in the course of construction, in addition to those already named.

The *Catskill and Canajoharie* railroad is 78 miles long, the first 22 miles are graded and the rail laid down. With the aid of the State, it is expected to complete this road and connect it with the Hudson and Berkshire railroad by the year 1842, the estimated cost is $1,200,000. This road will save some 30 miles between New York and Utica and strike the Hudson below the Overslaugh, at Catskill.

The *Hudson and Berkshire* railroad has been a year in successful operation, carrying, besides passengers and merchandize, large blocks of marble for the Girard College, Philadelphia, from W. Stockbridge to the city of Hudson, 33 miles, also a variety of manufactured articles from Berkshire county to the Hudson river.

This road intersects at the New York State Line the *Great Western railway* of Massachusetts. The distance from the city of New York via Hudson to Boston is 302 miles, by the N. Y. and Albany railroad the distance will not exceed 290 miles. The *Ithaca and Owego* railroad is 29 miles long, it connects the Erie canal and Cayuga Lake with the Southern railroad at Owego. This road is completed and in succesful operation;

it has had the aid of the State to the amount of $300,000. A very important railroad has recently been constructed from the coal and iron mines of Blossburgh in Pennsylvania by Corning in this State, to the Chemung canal and Seneca Lake, thus forming the connection of our salt and plaster regions with the iron and coal districts of Pennsylvania. When this line is extended from the outlet of the Seneca Lake and Erie canal to Sodus Bay, by the Ship canal (in the course of construction) the city of Philadelphia will have a communication with the Upper Lakes and the Canadas, through the State of New York which her citizens have long desired to accomplish.

The *Albany and West Stockbridge* railroad although not commenced, yet from the unanimity with which the citizens of Albany have voted to issue the stock of the city, for 650,000 to construct this road, thereby to connect themselves with Boston, it will soon be in progress. The pledge given to Boston on the part of Albany to construct this road, on the completion of the *Western* railroad of Mass., places the construction of the Albany and West Stockbridge railroad beyond a question. It should prompt the immediate construction of the New York and Albony railroad to preserve a share of the New England business, that now centres mainly in New York with our auctioneers and jobbers. Boston, with the advantage of a continued line of railways from her long wharf, by Albany to Buffalo, *to Oswego* and Lake Ontario will command a large Western trade.*

Mr. Cunard is about establishing a line of steam packets from Boston to England, when the trade of Mass. and the other New England States, it will be perceived, will render the construction of a railway from New York to Albany and Troy, a measure of the first importance. If neglected, the *Western* railroad of Massachusetts will divert a large share of our Breadstuffs "to Boston," to be exchanged with the best customers for her manufactured cottons and woollens and the great variety of maufactured articles now sold principally, in the cities of New York and Philadelphia for the West. The limited period of 7 months the Erie canal is navigable, with the Hudson river closed from Dec. on the average to the 17th March, render the construction of railroads indispensable to New York, to afford her customers a quick conveyance for their goods *at all seasons of the year.*

J. E. B

The memorial of Gen. Gaines to Congress, has been for some time upon our table. Its merits, however, are such as are not likely to be lost by keeping. We shall give such portions as are calculated to interest our readers.

TO THE SENATE AND HOUSE OF REPRESENTATIVES OF THE UNITED STATES OF AMERICA, IN CONGRESS ASSEMBLED:—*the memorial of Edmund Pendleton Gaines, Major General in the Army of the United States, commanding the Western Division, respectfully showeth, that—*

Believing the Federal and State Constitutions guarantee and consecrate to every free citizen capable of bearing arms, the *right* and *duty* of participating alike in the civil and military trusts of the republic—solemly requiring the soldier to exert his every faculty "*in peace to prepare for war.*"

* Since the foregoing was written, eastern capital has agreed to cash the Albany city bonds, and construct this road. Messrs. Mc Neill and Whistler are preparing to put the whole line under immediate contract.

so that on the recurrence of war he may be well qualified to fight the battles of his country in the greatest possible triumph, and at the least possible cost of blood and treasure—requiring him, moreover, to study and respect her political and social institutions; and requiring the statesman to discipline his mind for the state and national defence, by adapting his civil acts and occasional military studies to the purposes of the national defence and protection, as well against foreign enemies in war, as against the home incendiary and other *criminal offenders in peace*; thus rendering the statesman & soldier equally familarized with their common kindred duties of *self-government* and *self-defence*: by a knowledge of which our Independence was achieved, and without which this inestimable blessing cannot be preserved—your memorialist, a native Virginian, a citizen of Tennessee, schooled in *her cabins* and *her camps* to the profession of arms, has, within the last seventeen years matured a System of National Defence, to which he now respectfully solicits your attention and support: a system of national defence whicq the late giant strides of invention and improvement in the arts, have rendered *indispensable to the preservation of uniov*: a system of national defence which recommends itself peculiarly to the Central, Southern and Atlantic States as well as to those of the North and West; as it assures to our insolated central States of Tennessee and Kentucky, and to all the Western States of Ohio, Indiana, Illinois, Missouri and Arkansas, in peace, commercial advantages equal to those enjoyed by the most favored Eastern Atlantic or Southern States—and *in war*, giving to the disposable fighting men of these Central and Western States the inestimable privilege of flying with unprecedented certainty, celerity and comfort, to any of our vulnerable sea ports, to aid our brethren of the border States to repel the invading foe: and to accomplish this essential duty in one tenth part of the *time*, and one tenth part of the *expense*, that would attend such an operation over our present bad roads.

But above all, to accomplish these great and good objects by means that will more than double the value of our State and National Domain; and without expending a dollar that may not be ensured to be replaced in the public coffers in from seven to ten years after the completion of the work here recommended.

Your memorialist is admonished by the universal employment of Steam Power, and its applicability to every description of armament hitherto moved upon the sea by wind and canvass, or upon the land by animal power, that an epoch is at hand, in which the art of war, in whatever regards the attack and defence of sea ports, has undergone an unparalleled revolution.

Hitherto the transition *from peace to war*, between neighboring nations, though sometimes sudden and unexpected, was usually preceded by some significant note of preparation not easily mistaken; and after the actual commencement of hostilities, there were frequent opportunities and ample time for the belligerents, and more particularly for the nation acting upon the unerring principle of *self-defence*, to complete the *work of prepration for war*, before the *work of destruction* upon her principal sea port towns had been begun by the invading foe. Hitherto the enemy's fleets were to be seen for weeks, often indeed for months in succession, "*standing off and on*," waiting for suitable winds and weather to enable them to enter and attack the destined port, and then in case of accident, to carry them safely out again: winds such as could never be calculated on with any thing like certainty. Hence the great and unavoidable delay in the attack by fleets propelled by wind and sails, has often enabled the people of the threatened sea ports to throw up works of defence—and after slowly marching their interior volunteers and other forces, at the rate of 20 miles a day, they

would in time be so well prepared for action, that the menacing invaders have but seldom ventured to attack places of much importance; but have usually condescended to vent their prowess in a petty border war against villages and private habitations: as upon the Chesapeake Bay and the Georgia sea coast in the war of 1812—13—14.

If the obvious effect of steam power in the rapid movement of every thing to which it has been applied around us, has not been sufficient to convince us of the expediency and transcendant advantages, *in war* and *in peace*, of the proposed immediate work of preparation by steam power, to guard against the incalculable disasters that must otherwise attend the sudden out-break of war with any of the great nations of Europe able to send against us even a small fleet propelled by steam power, it would seem obvious that the late naval and military operations in the harbour of Vera Cruz were sufficient to prove clearly, that to bring a hostile fleet *inside the breakers* of a sea port of the country invaded, and within the desired range of the best of cannon and mortars for *red hot shot and shells*of one of the strongest castles in America, was the work of but two hours; and that the utter destruction of that castle by three small ships of war required but four hours more.

To provide for the defence of our sea ports—and thus effectually to obviate the possibility of a sudden calamity like that which has befallen the castle of San Juan de Ulloa, and to enable us to repel by the agency of steam power every invasion suddenly forced upon us by fleets propelled by steam power, I now submit for the consideration of the Notional Legislature the project and explanatory views which follow:

Art. I. *Floating Batteries*—for the defence of the sea ports and harbors of the United States:

Sec. 1. Your memorialist proposes the immediate construction of from two to four large Floating Batteries for the defence of each navigable pass into the Mississippi river; and from two to five others for the defence of every navigable inlet leading into any of the principal sea ports of the United States. Each floating battery to be from 200 to 300 feet long, and from 90 to 150 feet wide—the bottom to be as nearly flat as the best tested principles of naval architecture will allow, consistently with the great weight of timber and metal to be provided for, with the requisite facility of the movement that will be required over shoal water. Each floating battery to be secured in the bottom and sides with copper sheeting and copper or iron bolts; and on the upper parts, exposed to the enemy's shot and shells, with the thickest sheet iron, and iron bolts—and otherwise made capable of sustaining a heavier broadside than the largest of our ships of war is capable of sustaining; to carry from one hundred and twenty to two hundred heavy cannon—say long 24 and 32 pounders, with some 80 pounders for carrying hollow shot, together with some mortars for throwing shells; with a furnace for heating red hot shot for illuminating the enemy's fleets and transports. Each floating battery to have state rooms for the comfortable accommodation of from 600 to 1000 men, with store rooms for all the munitions of war requisite for that force for six to eight months service. Each floating battery to be attended and propelled by such number of tow boats as the exigencies of the service shall from time to time demand—to be permanently stationed in each harbor in time of peace: and in war as many tow boats to be chartered as the commanding officer may deem necessary to render the floating batteries in the highest degree efficient: as in war tow boats will seldom be needed for the merchant service, an ample supply of them, particularly in our large sea ports, may be chartered on moderate terms; for example, in the harbor of New Orleans it is believed that 12

tow boats, with several steamboats having the best of engines to be converted into tow boats, would be thrown out of employment during a state of war. These could be usefully employed in the United States service, in aid of the public tow boats and floating batteries. But should this reliance be deemed unsafe, we can readily adopt the obvious alternative, of having each floating battery supplied with two tow boats of great power, as in war they would be needed near the batteries, ready to wield them in the event of an attack, and at other times to act as tenders, in supplying them with men and munitions of war. In a state of peace the floating batteries, it is believed, would require but one tow boat each, excepting when employed in deepening the ship channels; a work which may be accomplished with the most perfect ease, and to any desirable extent, wherever the bottom of the channel consists of mud and sand, as in all the outlets of the Mississippi. This important work will be done by attaching to the bottom of each floating battery a frame work of *ploughs* and *scrapers of iron*, made to *let down* and *raise up* at pleasure, according to the hardness or softness of the clay and sand, or mud, of which the bar, or bottom of the channel may be composed. If very hard or tough, the ploughs and scrapers might not break up and take off more than two to four inches in depth at one movement; but where the bar is composed entirely of soft mud, as that at Balize and the N. E. and S. W. pass have often been, from four to six inches in depth it is believed may be carried off at once—wherever the bar is very narrow, and in the immediate vicinity of very deep water, which would be the reservoir, or place of deposite to which the mud and sand would be removed. But in a state of peace, when the batteries should not be employed in deepening the ship channels, their extra tow boats might be advantageously employed in the merchant service.

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5. But it has been contended by men of high pretensions in theory, if not in the practical science of war, that, in place of the floating batteries here proposed as means of *harbor defence*, we should direct our attention mainly to the construction of steam *ships-of-war*. In reply to this theoretical suggestion, it is only necessary to say that we must, indeed, ultimately have *steam ships-of-war*, or we must give up the whole of our foreign commerce; but if we desire to preserve our sea ports and commercial emporiums, we *must* have for their protection *floating batteries*—which constitute, in the present state of the arts, the natural link in the great chain of national defence, between the land and naval means of service: and as these floating batteries are not designed for going to sea (excepting near our ports and harbors in calm weather) they properly belong to the land service.—The fact that our sea ports are rendered more than ever liable to sudden and unlooked for attacks by fleets propelled by steam power, renders it all important to their security that our means of harbor defence should never, even for a single day, be left exposed to an assault, when that assault may, in all human probability, result in the destruction of one of our most vital points of military and commercial operations. If, however, steam ships of war should be preferred to the proposed floating batteries, a solemn act of congress should be passed, forbidding any officer from removing them beyond the immediate vicinity of the harbor to which they may be assigned; as it must be obvious that our sea ports cannot be protected without every requisite means of protection are held ready for action within our harbors, respectively. The floating batteries, it is believed, will cost but little more than the timber, iron, copper and other materials for their construction, if they are built as they should be, by the troops intended to defend them, aided by some ship carpenters to give them tight bottoms.

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6. With three to five of the proposed floating batteries placed in the form of a crescent across the Mississippi river, with the concave side of the crescent down the river, and this curved line of floating batteries flanked by a small temporary fort on each bank of the river, so as to bring the cannon of each fort or battery to bear on any fleet or vessel *ascending the river from the sea*, we should be certain thus to give each of the enemy's leading vessels *a double cross-fire*, raking them in front and on each side at one and the same time; with several of our heavy guns from each one of our floating batteries and adjacent forts *with red hot shot*—a description of defence which would to a certainty, in 99 cases out of 100, be fatal to any fleet that could possibly be brought against our line of batteries. But to make assurance doubly sure, we could have our floating batteries occasionally connected together by *chain cables* and *chevaux de frize*, which might sometimes bring us in close contact with a daring foe, as Nelson or our own Decatur and Perry were, in the mode of attack which characterized those chivalric naval commanders. But the contact thus produced would ensure to us the moral and physical effect of our efforts being in *self-defence*, with the superior strength of our *batteries, bulwarks* and *weight of metal*—advantages which we should enjoy from the moment the invading foe comes within the range of our long and heavy cannon, until he finds himself entangled in, and arrested by our *chevnux de frize*—where the contact would be so close as to enable us to throw into his ships *hand grenades* and *incendiary shells*, with an occasional supply of heated steam; whilst our own batteries would be preserved from a similar annoyance by their superior width, strength and peculiar structure of their upper works, which are proposed to be secured by sheet iron of immense thickness; a description of work which it is believed could not be so effectually applied to vessels of any thing like the ordinary model of ships of war desined for sea service.

But again—"to make assurance doubly sure," we should not risk such places as New York and New Orleans—by far the most vital and in a civil and (the latter more especially) in a military point of view, the most important sea ports in America—without at least two curved lines of defence, one at or near the entrance of the harbor, and the other at the next narrow, strong, interior point, fortified as above suggested, with the curved line of floating batteries flanked by a fort on each side of the river or channel; for example—for the harbor of New York, *the Narrows*—and for the Mississippi, *forts Jackson* and St. Philips. * * * *

8. So much for their uses in a state of war—then on the return of peace when the most expensive fixed fortifications are absolutely useless, and moreover, a heavy burden to the country to keep them in repair, floating batteries will be usefully employed as barracks and hospitals; and in deepening the channels, liable to be filled up by clay, and loam, and sand, as those at the mouth of the Mississippi river are often filled up. As floating barracks and hospitals, the proposed batteries would be of essential benfit to the service every where, inasmuch as the outlets of our rivers and sea ports are generally healthy positions; and they will form the most appropriate asylums for our convalescent or slightly disabled soldiers or seamen; most of whom will render essential service in preparing fixed amunition, and in the instruction of the young and inexperienced, and in holding them ready for action; above all, in a state of peace the proposed floating batteries will be of immense utility to the service for all purposes of *military schools*, to which the aspiring youth of our country of the community will gladly repair, for the attainment of military knowledge, where it can be acquired both *in theory* and *in practice*, and where its *study* and *practice*

will be rendered most delightful and praiseworthy by the simple process of *the students rendering immediate and important public service in return for the public instruction received by them.* The military education of our youth should commence at the age of sixteen, and be completed at the age of twenty-one, or twenty-two. If our youth are educated upon floating batteries at the entrance of our harbors, near the Balize, Sandy Hook or the narrows; otherwise, if the youth of each Atlantic or southern State, are educated at the entrance of the principal seaport of such State, the graduate after finishing his education would have the proud satisfaction of exhibiting to his parents or guardian, on his return home, the gratifying evidence of his having performed five years honorable service, while acquiring attainments qualifying him for a high—*perhaps the highest—command in the army:* attainments, too, tending to qualify him in no small degree for the highest stations recognized by the free institutions of our country; and exonerating him forever after from any other than mere voluntary service. * * * * * * *

Art. II. So much for *Floating Batteries* and their uses in peace and in war. Let us now proceed to consider the all important kindred measure of Railroads, for co-operating with the proposed floating batteries, and perfecting the promised system of national defence.

Sec. 10. We propose the immediate location and construction of seven railroads, to extend from the two central States of Tennessee and Kentucky to the seven grand divisions of the national frontier, as suggested by a plan embraced in the accompanying diagram, viz:

First—One principal railroad from Lexington, Ky., to Buffalo or Plattsburg, N. Y., with branches to Detroit, Albany and Boston.

Second—One principal railroad from Knoxville, Ten., to Norfolk, Va., or Baltimore, Md., with branches to Richmond, Va., and Newbern, N. C.

Third—One principal railroad from Memphis Ten., to Charleston, S. C. or Savannah, Ga., with branches to Milledgeville, Ga., and East Fla.

Fourth—One principal railroad from Louisville, Ky., to Mobile, Ala., with a branch to Pensacola, Fla.

Fifth—One principal railroad from Lexington, Ky., via Nashville, to New Orleans.

Sixth—One principal railroad from Memphis, Ten., to the Sabine ridge with branches to Fort Towson and Fort Gibson, Ark.

Seventh—One principal railroad from Louisville, Ky., or Albany, Ind., to St. Louis, Mo., and thence to the Missouri river north of the mouth of the Big Platte, with branches from Albany, Ind., to Chicago; and from the north west angle of the State of Missouri to the upper crossing of the river Des Moines.

11. These seven great arteries or principal railroads here enumerated will each be from 500 to 700 miles in length (averaging 600 miles) making altogether a distance of 4,200 miles, and the average cost of locating and constructing them is estimated at $15,000 per mile, amounting altogether to the sum of $64,000,000—provided they are located and constructed by the army of the United States: the railroads to be of the most substantial kind, each having a double track. The whole work to be completed by the authority and at the expense of the United States: provided that on its final completion it shall revert to the States in their sovereign and individual capacity—each State to retain, forever, the right of property in and to all of such section or sections of the said railroads, with all their appurtenances, lying or being within the territorial limits of such States, respectively—upon the single condition that all troops, whether regulars or volunteers, in the service of the United States, with their mu-

nitions of war, together with the mail, shall be transported forever upon these railroads, free of expense to the United States.

12. Without attempting to enumerate all the benefits to be derived from the proposed railroads, in peace, as well as in war—benefits which are for the most part too generally known to require any particular notice here;—(and others, certainly of very great value, can only be conjectured, inasmuch as they are to some extent *invisible*, and to be developed principally, it is believed, by the excavations necessary to complete the graduations of the basis of the work through the vast regions of *mineral wealth* over which its various lines will extend, where accident has hitherto led to the discovery of a sprinkling of gold, with millions of acres of the richest iron and lead ore and coal, together with copper and other valuable minerals;)—your memorialist will here concisely advert to the principal benefits which the military aspect of the proposed work promise, and conclude with a notice of such advantages as must immediately result to the *army to the several States* and the Union, from the organization and employment of the national regulars and volunteers as operatives upon the work.

13. *The principal advantages to be derived from the proposed railroads in a military point of view.*

In a state of war they will enable us to transport the military men and munitions of war of the two central States of the Union, and of all the interior districts of the twenty-four border States, to the seven grand divisions of the national frontier, without animal power, in one tenth part of the time and at one tenth part of the expense that the movement would cost in the present state of our bad roads. The proposed railroads would thus enable us to obtain more useful service in war from ten thousand men, by the increased rapidity and safety of their movement to the point of attack chosen by the invading foe, than without railroads we could obtain from an army of one hundred thousand men, marched upon our common roads; as, in addition to the saving of *time*, which in war is *power*, and *health*, and *life*, and *money* we shall save our citizen soldiers from what they usually deem the most irksome and insupportable afflictions and privations attending their tours of military service: we shall save them from long and tedious marches, and from the still more trying scenes of a long continued delay in camp, and the consequent painful *separation from wife, children, friends* and *business*. On the contrary, after being assembled and prepared for action, we shall *fly* to meet the invading foe at the rate of 250 to 300 miles in 24 hours—taking with us every desirable necessary of life for the preservation of health, activity and personal prowess; so that when we meet the enemy, we shall enjoy every desirable advantage in every conflict, in most of which we cannot but be successful; and in place of the usual campaign of three, six or twelve months of distressing service, we may reasonably calculate on being conveyed, with every desirable supply from the central States to the frontier, in the short space of 50 or 60 hours time, and of meeting and beating the invading foe, and returning to our homes in a few days, or at most a few weeks more. Hence the great utility of the proposed railroads in a state of war; and then, on the return of peace, when our 60 millions of dollars worth of fortifications, and armories, and arsenals, and ships of war are worse than useless, for any of the purposes of peace, and a great and constant expense to repair and replenish them in order to hold them ready for another war; then, our railroads, taking, as they must take, precisely the direction that the commerce of our country takes—from the seaboard to the central western States, will, when turned to commercial purposes, produce a revenue to the States that own them, that will be more than sufficient to replace, in seven years time,

every dollar expended in their construction; and forever thereafter produce a revenue sufficient for the support of all the State governments, and to pay for the education of every orphan child in America. The proposed railroads will do more—they will form ligaments of union more powerful than bulwarks of adamant, or chains of iron or gold, to bind the States together in perpetual union. In designating the military men of the central States of Tennessee and Kentucky, as the disposable force of the nation, we have reference to the fact that this force is rendered disposable by the central position of these two States—they having no frontier to defend; whilst the forces of all the other twenty-four States are rendered local forces, and not disposable, by reason of their being all border States—the boundary of each extending to the frontier; and therefore, having frontier of their own to defend, they are thus rendered local, not disposable.

14. Organization of the regular forces and operatives to be entrusted with the location and construction of the work.

One Major General; one Adjutant General, with seven assistants; two Brigadier Generals; seven Surgeons, with 28 assistant Surgeons; and 28 chief artificers, or scientific mechanics; seven regiments; each regiment to consist of one Colonel, two lieutenant Colonels, four Majors, one Adjutant and one Quartermaster, two sergeant Majors and two quartermaster Sergeants, with ten companies—each company to consist of one Captain, two first Lieutenants, two second Lieutenants and two Cadets, with one quartermaster Sergeant, one orderly Sergeant, four Sergeants, four Corporals, two musicians, ten artificers, and 80 private soldiers. The General, Field and Staff officers, with the Captains and first Lieutenants, to be taken from the officers of the Engineers, topographical Engineers, Artilery and Infantry now in service—officers of established reputation for professional talents, experience, industry, economy and exemplary habits; and to have the pay and emoluments of mounted dragoons, with 50 per cent. additional pay while actually employed as Engineers, superintendants or operatives upon the location or construction of the work.

15. *Location of the proposed railroads.*

The location must embrace the *nearest and best routes*—commencing within the two central States of Tennessee and Kentucky, and extending to the seven grand divisions of the sea board and northern frontier, as above suggested; to be ascertained, particularly through the mountainous regions, by a series of topographical surveys, and finally decided on and established by a board to consist of a General and four to six field officers, upon whose decision the Major General commanding upon this service should have power to act; to approve or disapprove the decision of the board upon the same principles that the President is authorised by the constitution of the United States to approve or disapprove an act of Congress.

These surveys will produce an immense mass of ***Mineral, Geological*** and ***topographical information*** of great value to the States and the Union, and of indispensable utility to every member of the army and militia of the nation who aspires to that employment in the national defence which leads to the true fame of a citizen soldier: information tending to develope the military and physical resources of every State and district preparatory to a state of war, and of essential benefit to the people of every class during a state of peace.

(To be continued.)

THE PRESIDENT SPEAM SHIP.

This vessel, the largest ever yet built, arrived here a few days ago under

the command of Capt. Kean, and is now lying in Sloyne. She is an exceedingly beautiful model; built of the best material that England and England's wealth can supply, and is in every respect a noble vessel. She is now (her engines not being yet on board,) what is in nautical term, called "light;" and loomes very large. Her proportions are, however, such but for the comparative size of the Queen's mail ships near her, she is so compact that she does not appear at even a short distance to be larger than the "Liverpool." A nearer approach, however, undeceives the beholder, and a visit on board, realizes to its fullest extent the conception of "a wooden world."

She is painted in man-of-war style, with gun ports, and is handsomely rigged as a three-masted schooner, with a foremast, fore-top-mast, and top-gallant-mast, approximating to those of a ship. Her bow is fine, and at the extremity of her head rails will be placed when completed, as a figure head, a bust of Washington, the hero of American independence. Her stern is projective, beautifully formed to turn off a heavy sea; ornamented aloft with the arms of England and America, quartered in heraldic shield, supported by "the Lion of England," and "Eagle of America." The paddle boxes are comparatively very slightly raised above her bulwarks; and her general appearance is, when her side is viewed, that of a first class frigate of extraordinary size, her light rigging giving her at the same time a most rakish and mischievous appearance.

The following are the dimensions:—

Length over all, from taffrail to figure head, -	273 ft.
Beam within the paddle boxes, - - - -	41 ft.
Breadth from outside of paddle boxes, - -	72 ft. 4 in.
Depth of hold, - - - - - - -	30 ft.
Height between the main and spar deck, - -	8 ft. 6 in.
Height between lower and main deck (both flush)	7 ft. 8 in.
Tonnage supposed 2500.	

Those who are versed in maritime affairs will readily conceive from these dimensions that we are warranted in stating that the President, is in reality, "a wooden world." She is indeed, more—she is a world not only of wood, but of iron, copper, and other materials, constituting the *ne plus ultra* of strength in naval architecture.

The President was built at Limehouse, London, by Messrs. Curling and Carter, the latter gentleman superintending her construction throughout.

Between decks and in her holds she presents a perfect picture of strength; and we cannot more highly compliment our metropolitan firiends and contemporaries in Translantic Steam Navigation, then by stating that they seem in materials, in fastenings, and in putting together, to have taken a leaf out of the book of our townsmen Messrs. Wilson and Co., whose vessels both in point of strength and sailing have hitherto borne the belle.

Every available modern improvement has been taken advantage of in the construction of the President. In addition to a remarkably strong frame, solid to the bilge, she is diagonally fastened fore and aft with iron and wood, in a manner that would seem to defy the rudest assaults of the ocean wave. We have not time to enter into details. Suffice it to say, that the materials of the *President* throughout are of the best quality, and that the utmost science, in a scientific age, has been exerted to work them to the best advantage.

The engines for this vessel will be of about 600 horse power. They are already built by our townsmen Messrs. Fawcett and Co., and present a splendid specimen of the ingenuity and enterprise of the age.

The *President* will present peculiar advantages for passengers. Her

spar-deck will afford a long and delightful promenade in fine weather, and during rain or storms a dry and sheltered walk may be enjoyed below.

The cabins are not yet fitted up. The principal or stern saloon will be eighty-seven feet in length; its breadth (including the small state rooms on each side) forty-one feet.

No expense has been spared to render the *President* a crack ship. In strength of materials and fidelity of workmanship, she is fully equal to any of her Majesty's ships of war; and is fitted up with all the modern improvements in pumps, tanks, &c. She is also divided into sections, so that the springing of a leak (should such take place) would be attended with comparatively trifling danger. It is calculated that the *President* will carry 1,000 tons of goods beyond her compliment of coals, luggage, and materials for a transatlanitc voyage. Her steering tackle is of novel and improved construction; and such was required; for, from her length and size, she may be deemed a floating island.

The agents of the *President* at this port, are Mr. Pim, of the St. George's Steam packet Company, and Mr. Macgregor Laird, brother of Mr. Laird, of North Birkenhead, the celebrated builder of Iron ships.

New York and Albany Railroad.—In a former number, the importance of the New York and Albany railroad was presented, in connection with the efforts of Boston to divert part of the trade of the West to that city during two thirds of the year, and the whole of it during the remaining one third, after the closing of the Erie canal and Hudson river. Its cost, on an actual proposal of $2,450,000 with security, was presented, as well as the superiority of this route over all others.

It now remains to be asked, can the New York and Albany railroad pay an interest to its stockholders on its cost, with the noble Hudson river only 15 to 25 miles distant, on which steamers are runniug at from $1 to $2 per passenger, exclusive of meals? I answer in the affirmative; and I will endeavor to substantiate the same by a few but important facts.

The disposition of the American people "to go ahead," with their desire for variety, is such, that the route that carries the mail and saves 4 or 5 hours in time, will take its share of passengers. The railway will certainly carry all the way travel, which now passes by the Hudson river to New York, from Berkshire, Massachusetts, Litchfield Connecticut, and the East parts of Columbia, Dutches and Putnam Counties. It is calculated that from 1000 to 1500 persons pass to and from different points on the Hudson river by steamboats daily. The average of persons coming from and going to the West over the Utica and Schenectady railroad, may be stated at 200,000 persons annually. Of this number it may be estimated that 50,000, including the winter travel, would take the New York and Albany railroad.

This item, at $2 50 each, equals	$125,000
(See Assem. Doc. of 1839, No. 171, for details of estimates)	
The *way travel*, has been estimated by Mr. W. C. Redfield and other intelligent gentlemen, at above	$100,000
This road will transport over it at least two trains of 100 tons each daily, from the towns on the line, at say the average rate of $3 per ton. This item will give 73,000 tons, or (See Assem. Doc. No. 171, 1839)	$219,000
If the road is well regulated, with suitable *turnouts*, ten times this amount may be conveyed over it daily, at even half this expense. The U. S. mail at the present rate allowed by law ($300 per mile) will yield	$44,000
	$488,000

That the traffic will be immense on the line of this road, towards its termination, is shown from the fact, that it is destined to become the great thoroughfare to supply this increasing city *with provisions and building materials.* This too, without taking into view that all the *early* Spring trade in merchandize from the city of New York to the West, *must* seek the railway, at any price of transportation, to keep pace with this *new mode of transportation.* It will be safe to give the road $200,000 in addition to the estimate, for the trade and traffic from the towns on the line of the road to Albany and Troy. The gross income will exceed $688,000 per annum, and must increase yearly with our population and wants.

There are advantages to the residents in this city, and its vicinity, in the reduction of prices for the necessaries of life, that it is difficult to calculate by dollars and cents. The importance of the road, in this point of view, to the property holder, the merchant, the mechanic, and the laborer, is great. To the latter, in the necessary article of milk, the calculation is a striking one. There are at least 50,000 families (6 persons to a family) in this city and in brooklyn, who consume 3 pints per day, at an average in price for the *pure* article, of 7 cents per quart, winter and summer. This calculation does not include the steamboats, packets and extra quautities for hotels.—75,000 quarts for 365 days is 27,375,000 quarts per annum, at 7 cents $1,916,250

It has been ascertained, that milk reduced to butter, does not nett the farmer in Dutchess, to exceed one and a half cents per quart, supposing the butter sold at 25 cents per lb.—Say, then, 4 cents per quart of milk, to include profit on delivery in this city, equals 1,098,000

May be saved yearly in the item of milk $818,250

In the item of the reduced price of *Vegetables*, for the daily tables of 50,000 families, it is safe to say one shilling each will be saved per day. This in 365 days at $45 per family, will amount to the enormous sum of $2,225,000,—or $6,250 daily.

On the closing of our canals, for five months in the year, the daily consumption in this city of flour is 1,500 barrels. During the summer it varies from 1000 to 1200 barrels per day. 150 days at 1500 bbls. equals 225,000 bbls. It is well known to our bakers, that on the closing of the Erie canal, we are in the power of speculators, who advance the market from one to three dollars per bbl. The difference in value to the consumers (from not having a line of railways to the wheat districts) may be safely put down to the consumers, in this city and its vicinity, at $500,000;—and on the quantity required for the consumption of the New England States, at one million of dollars.

The *mineral* resources along the line of the road, particularly *in Iron*, are immense. The State Geological Reports of 1839, give the items in detail.

Marble and *Granite* abound—so do ship timber, wood, and charcoal, with every agricultural product required for a growing city. On a rough estimate, there are at least 30,000 horses and cows on and near this island, with cattle sent here for sale, which consume on an average two tons of hay per annum each :—say 50,000 tons of hay. The railroad will save to the farmer and consumer at least $7 per ton, and this will equal $350,000.

Other and more enlarged views, may be taken of this work. *In a military point of view*, its construction and connection with the U. States Arsenal at Watervliet, is important—it will unite the Sea Board with our inland seas and the far West—and be a means of defence to this city.

Without a railway to Albany, and through the State, we never can succeed with manufactures, particularly cotton. The new crop comes to market principally after the canals and the North river are closed. The period is not far distant, when the State of New York will be *the centre* of the *manufacturing district* of the United States. The *Grain district* must pass to the States of Ohio, Michigan, Indiana and Illinois, as our narrow belt of wheat land becomes yearly exhausted, or more valuable to produce stock, butter and cheese.

The *Cohoes Falls* may be made the Manchester of America. With a railway to Troy and to this important water power, for the supply of cotton and the return of the manufactured goods, the value of this property would be more than doubled. The same may be said of the property and water power, at the Little Falls. At the Cohoes, upwards of $800,000 of New York and Eastern capital has been invested, and a very large sum at the Little Falls. These several Companies could give, with profit to themselves, one third of their investments, to secure an uninterrupted communication to the Mills. It is to be hoped the period has arrived, when the Chamber of Commerce, the Board of Trade, with our land holders and citizens generally, will make a united effort, to complete a railroad within our own State and jurisdiction *direct* to Albany.

Let the "*Right of Way*," or ground over which to construct the road, be got forthwith. By proper management, it will cost the Company but a trifle. Let a subscription to the stock of the Company be started, in every election district, in every ward in this city. If placed in proper hands, there cannot be a doubt but that $1,500,000 to $2,000,000 can be obtained in small sums, from those interested in the immediate construction of this road. Let it by all means be completed simultaneously with the Albany and West Stockbridge road. This event may then be celebrated with as much pomp and final advantage to this city, as "the mingling the waters of the Upper Lakes with those of the Atlantic." The one gave us a communication with the West, seven months in the year;—the railway, will give us communication with the interior the whole year; and in the view of many, the advantages to this city of one improvement compared with the other may be estimated in favor of the railway over the canal, as 12 to 7; certainly when we take into consideration the trade we are on the eve of losing, from the steady enterprize of our Eastern neighbors.

Jos. E. Bloomfield.

INSTITUTION OF CIVIL ENGINEERS.

Feb. 21,—The President in the chair.—The following communications were read:—

"On Steam Engines, principally with reference to their consumption of Steam and Fuel." By Josiah Parkes, M. Inst. C. E.

The above is the second and concluding communication on this subject; in the former, the generation of steam more particularly was considered; in the present, its application when generated. These are distinct questions, as it is the economy of steam which constitutes the dynamic perfection of a steam engine, whereas it is the economy of heat in supplying that steam which constitutes the perfection of the boiler as an evaporative vessel. These economic properties are totally independent of each other; they may co-exist in a maximum degree, or in very different degrees, and the degree of perfection which any particular class of engines, or which the particular engines of any class possess, is known from the weight of fuel burnt, of water evaporated, and the mechanical effect realized. As

long as engines were constructed with but few varieties, or identical in their forms, the performance of one was a sufficient indication of the performance of all; but new forms of engines and new modes of practice being now introduced, a comparison of the performance on the several systems is a matter of deep practical and scientific interest. With the view of effecting this object, the author has collected all the authentic facts within his reach, and reduced them to common standards of comparison.

The effective power of steam engines may be ascertained either from the resistance overcome, or from the load upon the piston by means of the indicator; the former method being applicable to pumping, the latter to rotative engines. But the effective power of the steam in pumping engines, as thus ascertained, is far below the real effective power of the steam, and no exact comparison can be made by these means between the effective power of the steam in the two classes of engines. The useful effect is not synonymous with a true measure of effective power, since the duty is the true useful effect in a Cornish engine. The indicator when applied to the Cornish engines enables us to ascertain the absolute but not the effective power, so as to compare it with that of the rotative engine, since the friction of the engine and the load cannot be separately determined. The absolute power of the steam may also be ascertained from the relative knowledge of the elastic force of steam corresponding with the ratio which the volumes of water bear to each other. This theoretical estimate requires, however, several corrections; among which the steam condensed by contact with colder surfaces, the steam consumed in filling useless places, and that lost by priming, must be particularly noted.

The relative performance of pumping engines is well expressed by the term "duty," that is, the number of lbs. raised one foot by a given quantity of fuel; and of rotative engines by the term "horse power;" that is, the number of lbs. raised one foot in a minute, divided by 33,000 lbs. the standard measure of a horse. The performance of the rotative engine may also be estimated by duty, and of pumping engines by horse power. The results of these computations for several engines are tabulated in this communication.

The sum of the latent and sensible heat being constant for steam of all elasticities, the expenditure of both power and heat is truly measured by the weight of water consumed as steam; this measure is free from all uncertainty, and independent of all theory; the weight of water as steam is equivalent to the production of a horse power in each engine, and the duty effected by one pound of steam, will denote the positive and relative efficiency of the steam and the heat. These indices of efficiency being referred to some standard, we learn, from the preceding data, the precise value of each engine in its use of steam and fuel: of its boiling apparatus, as a generator of steam; of the comparative efficiency of the steam and coal, or economy of power and fuel. The results which may thus be obtained are also exhibited in tables accompanying the communication.

The power resulting from the expenditure of equal weights of water, as steam, being known, the boiler may be connected with the engines, and the relative extent of heating surface employed to furnish their power shown. It will thus appear that equal measures of surface are quite inadequate to supply equal power, with equal economy, to different classes of engines. These results are tabulated in great detail, and it appears that the Cornish engineers now employ nearly eight times as much boiler surface for equal nominal power as that given by Watt's practice. But taking into account the fuel burnt per horse power per hour in the two cases—the Cornish engine consuming 2½ lbs. per horse power per hour, and Watt's engine

8½—the true relation of the boilers is as 19 to 1. Many other relations of a similar striking character may be deduced from these tables.

The detailed results of the experiments by Smeaton in 1772, on his improved Newcomen engine at Long Benton—by Watt, in 1786, on his rotative condensing engine, at the Albion Mills, are recorded in these tables; and it appears that the economy of the latter, as regards steam and fuel, was double that of the former, and approached very nearly to perfection in the use of power obtainable on that principle. The next great advance in the economy of fuel and power is that made by the Cornish engineers, whose performance, both with pumping and rotative expansive engines, far exceed any attained with the common unexpansive condensing engines. The superiority of two of these engines in 1835, doing a duty of 80 millions, exceeds the engines of Watt and Newcomen by 2½ and 5 times in economy of power, and by 3½ and 7 times in economy of fuel.

The obtaining a standard measure of duty is of great importance; a heaped measure, as a bushel of coals, is highly objectionable, as the weight of such measure will vary from 84 to 112 lbs. In the Cornish reports, the bushel is fixed at 94 lbs. weight, as the standard of comparison, but some portion of a ton or one lb. would be a better standard. Other combustibles, however, as coke, peat, &c., may be used partially, or to the exclusion of coal, and under these circumstances, some other standard of comparison is necessary, and with this view the author suggests a pound of water in the form of steam as the best standard of duty. The work done by a given quantity of water as steam is a sure index of the quality of the steam engine; it is a measure unaffected by variable calorific agents, and so long as engines continue to be worked by steam, so long will the performance of different engines be accurately gauged by their respective expenditure of water as steam. The accuracy of this measure depends on the physical fact of the constancy of the latent and sensible heat in steam of all temperatures. The author has recorded twenty-eight experiments made on twenty-eight different days, on vaporization from the boiling point to 60 lbs. pressure above the atmosphere, which present a remarkable confirmation of the above law, and show that the relative efficiency of steam in engines is due to the manner of using it, and not to any change in its chemical constitution at different pressures. The manner of conducting these experiments, and the precautions taken to insure accurate results, are detailed with great minuteness.

The author next proceeds to treat of the locomotive engine, and to discuss, compare and tabulate the facts relating to this engine in the same manner as he has done those of the stationary class. The qualities of the boiler of the locomotive as an evaporative vessel had been discussed in the first communication. The locomotive differs from the fixed non-condensing engine only in the use of the blast, and the same method of measuring the effects of the steam are applicable to both. Experimenters on the locomotive have generally attempted to determine the amount of resistance opposed to its progress, in preference to ascertaining the power expended in overcoming the resistance. The exact solution of either of these questions would furnish all that is wanted; but the ascertaining the total resistance by an analysis of its several constituents is attended with great difficulties, as the forces to which they are to be referred are so exceedingly numerous and variable, that the assigning the exact value to each at any one velocity has hitherto eluded the talents of those who have pursued this method. M. de Pambour was the first analyst whose labours will require attention. The results given by this author in his practical treatise on locomotive engines on railways were compared by Mr. Parkes with the

results which he had obtained when experimenting on an engine of precisely a similar character, and discrepancies presented themselves which appeared totally irreconcilable. These and other circumstances led the author to consider, whether the resistance to traction would properly be deduced from the laws of gravitation, or whether any certain results would be derived as to the amount of resistance on a level from observations on engines and tains moving down inclined planes. The great object seemed to be to discover some criterion of the mechanical effect produced by a locomotive at all velocities, which would apply as practically and as distinctly to a locomotive as duty to a pumping engine, or horse power to a rotatory engine. If this were possible, it seems of far less importance to distinguish the precise value of each particular unit of resistance, than to determine the relative sum of resistant and the relative expenditure of power at all velocities and under all circumstances. Now the term duty may be applied in the strictest sense of the term to the work done by a locomotive engine; for whether the engine drag a load whose resistance is 8 lbs. per ton, or whether a weight of 8 lbs. for each ton of matter moved descending over a pulley and attached to the load, be considered as the moving force, the result is the same. If, then, the tractive force, or resistance per ton of matter in motion, which is the real load on the engine, be ascertained, the whole effect is found by multiplying this sum by the space passed over in feet; and the consumption of water as steam and of coke being known, we have all the elements requisite for determining the duty performed by the steam or coke. The pressure against the pistons may be deduced from the sum of the resistances first calculated on the assumed resistance overcome at the velocity of the engine in each experiment; and the pressure on the pistons may also be deduced from the ratio of the volumes of the steam and water consumed. The results which may be obtained on these principles are tabulated, for the experiments of M. de Pambour, Robert Stephenson, and Dr. Lardner. In another table the author has recorded the reduction of each of these experiments to terms of horses' power, and has exhibited under that denomination the absolute power resulting from the steam used—that required to overcome the assigned resistance—their differences—and the power which balances the gross and useful duty. The construction of these most elaborate tables is described in great detail, and the consequences which follow from the tests thus obtained are fully stated, and the author comes to the conclusion, that results inconsistent with the capabilities of the locomotive are perceptible in almost every one of the experiments. A condensing engine placed on wheels, with water of condensation transported for its supply, and made to drag a train along a railway, would require the same expenditure of water as steam to produce a given effect, as if fixed; a non-condensing engine also is one and the same machine, whether fixed or locomotive, excepting that the latter must consume more power than the former, to do equal work, at like pressures, by the amount of the additional resistance arising from the contraction of its eduction pipes, in order to produce a fierce blast of steam through the chimney. From these and other causes the fixed non-condensing engine must be the more economical of the two; but if the results derived from M. de Pambour's data be correct, we must acknowledge the fixed non-condensing engine, with its simple atmospheric resistance, to be far inferior in economy of steam to the locomotive, with its plus atmospheric resistance. The experiments by Dr. Lardner were made for the purpose of determining the resistance opposed to progressive motion on railways. They consisted in dismissing trains at various speeds from the summit of inclined planes, and in observing their velocity when it became uniform, the resistance at such velocity being

equal to the accelerating force of gravity down the inclined plane. The results of these are tabulated in the same manner as the preceding, and the most singular discrepancies present themselves. For instance, it would appear that in one particular case a duty of double the amount of that effected by the condensing engine was performed by an equal expenditure of power; that compared with a fixed non-condensing engine at equal pressure, the locomotive, though laboring against the heavy counter-pressure of the blast from which the other is free, is assumed to have performed equal work with less than one half the expenditure of power. That if the resistance assigned by Dr. Lardner as opposed to the progressive motion of the train be correct, the efficiency of the steam in the locomotive is more than double that obtained by the best condensing engines; more than treble that derived from stationary non-condensing engines, and equal to the performance of a Cornish expansive engine, doing a 50 million duty with a bushel of coals. With such results before us, the resistances assigned as opposed to and overcome by the locomotive at different velocities, must be regarded as utterly inconsistent with reality, and as resting on no solid foundation.

(To be continued.)

Institution of Civil Engineers.—At a weekly meeting of this influential body, on Tuesday the 25th of February, three models were brought forward, which are worthy of a few words of notice The first of these was that of a canal boat, of small breadth of beam, and draught of water, about 80 feet long, and fitted for traction at the rate of 10 or 12 miles in the hour; the same as the port boats on the Ardrossan canal, in Scotland. The peculiarity of this model consists in the adaptation of an 80 feet boat to 60 feet locks, which is accomplished by having 10 feet at each end of the boat articulated by hinges, so that they may be turned into a vertical position when about to enter the lock. It seems that the weight of the men who conduct the boat is sufficient to make those movable ends act as part of one entire structure, when the boat is in progress through the water; and the additional pressure on the permanently horizontal 60 feet by the turning of them up, is an advantage rather than otherwise, when the boat is in the locks. This plan has been tried upon the Irish canals, and has succeeded.

The second model is, in our opinion, a very choice and valuable one. It is a sliding jack, by means of which the conductor and stoker of a railway engine can replace it on the rails without further assistance, in the event of its slipping off. It was very justly observed by Mr. Walker, the highly talented president of the Institution, "no railway train ought to be without this machine, which is of small weight and ready use, and can be carried in the tender with no trouble, and very little want of power."

The third model was that of a new mode of attaching the axis of the paddle wheels of a steamboat to the horizontal shaft of the engine, and detaching the same when necessary. We had not time fully to examine it, but from what we saw, we are inclined to think that it bears more analogy to the fable of the progeny mountain in labor.

Windsor Castle.—An accident, though as hitherto not a very serious one, which has occurred in this splendid national structure, shows how dangerous it is to tamper within the vicinity of the foundations of a ponderous building. This was a fracture of the wall at the north western extremity, close to Winchester tower, constructed by, and once we believe the residence of, the illustrious William Wykeham, and now the abode of Sir Jeffrey Wyatville. This fracture has extended to a length of twenty-five yards, and, as far as it has been explored, it extends down to the very found-

ations, and continues widening. The latter circumstance shows that the mischief done must be in the foundation not in the building, and that it may be much greater than it is at present. It seems that the cause of this, at least in so far as known, is the digging of a deep trench close to the new terace wall, by order of the dean and canons of Windsor, who are proprietors of the ground here. The intention was to carry off the water which ran from the terrace, upon the slope; but, from some cause or other, it did not answer this purpose. The ditch became a stagnant sink, the water of which soaked in towords the foundations, at the same time that the continuity of the abutment formed by the slope was broken; and, consequently, the wall of the new terrace, which is comparatively a green wall, was left without the requisite support. Thus, the operation was much the same as if one were to take out the backing of an abutment of a bridge, and fill its place with stagnant water, and the consequence has been similar. This is a remarkable instance, not only of the danger of allowing unskilful persons to tamper with what they do not understand; but, also, of that of allowing any party but the public to hold property, and carry on operations upon it, near to a building of such national honor and importance—to say nothing of expense—as this most splendid of British palaces.

Great Western Railway.--The ten-feet wheels attached to the locomotive engines employed on this railway not being found fully to answer the expectations of the directors, they have altered their plan, and in future wheels of seven feet diameter are to be employed. The result has been the attainment of the speed of fifty-six miles an hour. On Saturday, the 28th ult., the "Firefly," a new engine manufactured on this principle by Messrs. Jones & Co., of the Viaduct Foundry at Newton, made an experimental trip from Paddington to Reading, and the following is a statement of her performance. She left the station at Paddington at 13 minutes 18 seconds past 11 a.m., and reached Reading at 59 minutes 43 seconds past 11, having passed the first mile post at 11 hours 15 minutes 57 seconds, and the 35th at 11 hours 58 minutes and 44 seconds, which is equivalent to one mile in one minute and 17¾ seconds, or more than 46 miles an hour. During the journey one of the tender springs broke and caused some additional friction on the axles. The load was two carriages and one truck. At 3 hours 19 minutes and 2 seconds the party started on their return to London with two carriages. They stopped to take in water at Twyford, which detained them 14 minutes and 44 seconds, and finally arrived at Paddington at 21 minutes 3 seconds past 4. The 29th mile post from London was passed at 3 hours 44 minutes 50 seconds, and the second at 4 hours 16 minutes 21 seconds, which is equal to the speed of one mile in 1 minute 11⅔seconds, or an average of 50⅓ miles per hour. The greatest speed attained was from the 26th to the 24th mile post, which was done at the rate of 56 miles an hour. This is the greatest speed at present attained in the history of locomotive power; what will ultimately be the greatest it is impossible to foretel.

Liverpool and Manchester railway.—On Thursday night, the 14th inst., the heaviest load of merchandize that perhaps has ever been collected into a single train was transported from Liverpool to Manchester by two engines, the Elephant and the Hercules. The train consisted of 106 wagons, laden with cotton, sugar, and various other articles of produce, occupying an entire length of about one quarter of a mile. A tolerable accurate computation of the extent may be made by observing that the length of each wagon is three yards, the space between about one, and the engines, with their tenders, 22 yards; the distance from the foremost engine to the

last engine would thus be 442 yards. The weight of this mass of matter would, no doubt, exceed 600 tons; the average weight of the wagons, merchandize included, being nearly 5 7-8 tons, the two engines 28 tons. On arriving at the foot of the Whiston plane, the engines were of course stopped, to permit the division of the train into the requisite number of manageable portions, and the whole load, in three or four successive trips, was soon transmitted to the summit. Proceeding to the Sutton incline, a detention occurred in the descent, in consequence of the breaking of a chain which coupled two of the wagons; but after this interruption no accident took place, and the train arrived in safety at the end of its journey. We understand that the Liverpool and Manchester company have lately introduced an alteration in the system of working their merchandize, the bulk of which is transported at night, to ensure delivery at an early hour in the morning.

Improved method of making bricks.—"A simple method of making bricks is made use of on the Great Western railway on Mr. James Bedborough's contract at or near Marston. This mode, which is the invention of W. B. Prichard, Esq., Civil Engineer of this railway, and late of the Chester and Crewe railway, is as follows:—The clay, only wattered, is thrown into a common pugg mill (or mortar mill;) there it is ground in a similar manner to mortar; the bottom of the mill is divided into four quarters, into which are grooves cut, and under which are placed four moulds of the same kind as those in common use by hand moulders. Two boys are at the quarters taking the moulds out and placing others in; and by a peculiar knife in the bottom of the mill, which presses the clay into the mould, eight bricks are made every time the horse goes round, which is twice a minute; and at that rate the horse can travel twenty miles in twelve hours, thus making 960 an hour, or 11,520 per day. The bricks made by this machine are much heavier and sounder, and the clay much better tempered, than by any other mode of manufacturing that I have ever witnessed; and the saving of 2*s.* 6*d.* per thousand, besides other advantages, etc. Mr. Prichard informs me that he intends to present a model in a few days to one of the London Galleries. The whole cost of the machinery is about 10*l.*"—*Railway Times.*

The Oscillating Steam Engine.—This description of steam engine was invented many years since, by M. Schwartz, Professor of Technology, at Stockholm, who constructed a twenty-five horse power boat engine on this principle, with the most complete success. His engine had its two cylinders and condensers, swinging side by side of each other upon solid trunnions at the lower ends of the cylinders and condensers. There was, therefore, no difficulty in effecting condensation. The steam was admitted thro' the stuffing boxes placed close to the trunnions. The connection of the air pump placed between the cylinder and condensers was also effected in a similar manner. About five years ago this gentleman came to England, and Mr. Gill submitted his plans to most of the engineers in the metropolis, but no one would take it up. Recently, however, Messrs. Penn, the engineers, of Greenwich, have fitted many boats with oscillating engines, but have not, by all accounts, adopted all the improvements which M. Schwartz proposed. Mr. G. states the advantage of these boat engines to consist in their compactness and admirable disposition of weight, which also answers all the purposes of ballasting. Their principle advantage, however, appears to be *in the cylinder playing to the circular movement of the cranks without requiring the help of parallel motions.*

A new and effectual method to Kyanize timber.—Within the last two or three weeks the Manchester and Birmingham railway company have commenced Kyanizing their wood sleepers in a much more quick and effectual manner than by the old mode of simply depositing the timber immersed in the prepared liquid. The company have made a large iron cylindrical vessel, weighing about ten tons, and which is about thirty feet long and six or seven in diameter, made from wrought iron plates, five-eights thick, and double rivetted, which vessel is capable of resisting a pressure of 250 lbs. on the inch. This vessel being filled as compactly as possible with wood sleepers, twelve inches broad and seven inches thick, the liquid is then forced in with one of Bramah's hydraulic pumps, and worked by six men to a pressure of 170 lbs. on the inch. By this means the timber is completely saturated throughout in about ten hours, which operation, on the old system, took some months to effect.

New Steam Vessel.—Experiments are in the course of being tried with the model of an entirely new form of steam vessel, and, as far as they have yet gone, with every prospect of a successful result. At present we can only state of this remarkable invention, that there are no paddle wheels, nor external works of any kind. The whole machinery is in the hold of the vessel, where a horizontal wheel is moved by the power of steam, and, acting upon a current of water, admitted by the bow and thrown off at the stern, propels the mass at a rapid rate. By a very simple contrivance of stop-cocks, etc., on the apparatus, the steamer can be turned on either course retarded, stopped, or have her motion reversed. This will be literally a revolution in the art of steam navigation.—*Hampshire Adv.*

A meeting of merchants was recently held at Trieste, at which the Archduke John presided; the object was the construction of a railroad from Trieste to Vienna. According to the plan of the engineer, Sommering, the only interruption to the line is a few miles of very mountainous country, which will be travelled by horses. At the castle of Duino, about three leagues from Trieste, the railroad will join the great Lombardy and Venetian branch. The Archduke expressed his admiration in the warmest terms; and added that it was the earnest wish of the emperor that this great desideratum should be effected, by which we may bid adieu to the shores of the Adriatic in the morning, and sleep in the Austrian imperial capital the same night.

Safety valves.—M. Sorrel has announced to the Academy of Sciences the invention of a safety valve, which, at the amount the pressure has passed a certain limit, announces the fact by a whistle, and stops the combustion of the fire by shutting a register or damper. A second, but different, sound, tells when the boiler is growing short of water.

St. Petersburgh, March 26th.—There are a great many workmen employed on the railway between Vienna and Warsaw, and we understand that no time will be lost in finishing this important undertaking.

The receipts of the Hartford and New Haven railroad for the month of May, were—

For freight, - - - - - - - - - -	$750 09
" passengers, - - - - - - - - - -	6,690 04
Total,	$7,440 13

The expenses of operating do not exceed $1,800, including repairs.

The receipts on the Norwich and Worcester railroad, during the months of April and May, amounted to $23,498 11.